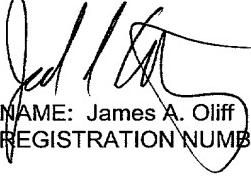


(1390 REV. 5-93) US DEPT. OF COMMERCE PATENT & TRADEMARK OFFICE TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER 105895 U.S. APPLICATION NO. (if known, sec 37 C.F.R.1.5)
		09/509669
INTERNATIONAL APPLICATION NO. PCT/JP99/03927	INTERNATIONAL FILING DATE July 22, 1999	PRIORITY DATE CLAIMED August 5, 1998
TITLE OF INVENTION OPTICAL MODULE		
APPLICANT(S) FOR DO/EO/US Akihiro MURATA and Shojiro KITAMURA		
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US) 6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)). 		
<p>Items 11. to 16. below concern other document(s) or information included:</p> <ol style="list-style-type: none"> 11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A small entity statement. 16. <input type="checkbox"/> Other items or information: 		

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5) 09/509669	INTERNATIONAL APPLICATION NO. PCT/JP99/03927	ATTORNEY'S DOCKET NUMBER 105895	
17. <input type="checkbox"/> The following fees are submitted:		CALCULATIONS	PTO USE ONLY
Basic National fee (37 CFR 1.492(a)(1)-(5)):			
Search Report has been prepared by the EPO or JPO.....\$840.00			
International preliminary examination fee paid to USPTO (37 CFR 1.482).....\$670.00			
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$690.00			
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$970.00			
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....\$ 96.00			
ENTER APPROPRIATE BASIC FEE AMOUNT = \$840			
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)). \$			
Claims	Number Filed	Number Extra	Rate
Total Claims	18 - 20 =	0	X \$ 18.00
Independent Claims	4 - 3 =	1	X \$ 78.00
Multiple dependent claim(s)(if applicable)		+ \$260.00	
TOTAL OF ABOVE CALCULATIONS = \$78			
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28). - \$			
SUBTOTAL = \$918			
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 month from the earliest claimed priority date (37 CFR 1.492(f)). + \$			
TOTAL NATIONAL FEE = \$918			
		Amount to be refunded	\$
		Charged	\$
a. <input checked="" type="checkbox"/> Check No. <u>107519</u> in the amount of <u>\$918</u> to cover the above fees is enclosed.			
b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed.			
c. <input checked="" type="checkbox"/> The Director is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No. <u>15-0461</u> . A duplicate copy of this sheet is enclosed.			
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.			
SEND ALL CORRESPONDENCE TO: OLIFF & BERRIDGE, PLC P.O. Box 19928 Alexandria, Virginia 22320			
 NAME: James A. Oliff REGISTRATION NUMBER: 27,075			
NAME: Joel S. Armstrong REGISTRATION NUMBER: 36,430			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Akihiro MURATA and Shojiro KITAMURA

Application No.: U.S. National Stage of
PCT/JP99/03927

Filed: March 31, 2000

Docket No.: 105895

For: OPTICAL MODULE

PRELIMINARY AMENDMENT

Director of the U.S. Patent and Trademark Office
Washington, D. C. 20231

Sir:

Prior to initial examination, please amend the above-identified application as follows:

IN THE CLAIMS:

Please amend claim 16 as follows:

Claim 16, lines 1 and 2, change "any one of claims 4 to 15" to--claim 4--.

REMARKS

Claims 1-18 are pending. By this Preliminary Amendment, claim 16 is amended to eliminate a multiple dependency. Prompt and favorable examination on the merits is respectfully solicited.

Respectfully submitted,


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2/PR

09/509669
430 Rec'd PCT/PTO 31 MAR 2000

OPTICAL MODULE

TECHNICAL FIELD

The present invention relates to an optical module
5 which is formed by integrating an optical element, optical
waveguide, or the like.

BACKGROUND ART

An optical module is a transducer from electrical
10 energy to light, or from light to electrical energy. An optical module is constituted in hybrid integrated form by an optical element, an optical waveguide, an electrical circuit, and the like. An optical module is used, for example, in an optical fiber communications system.

Fig. 3 shows schematically the disposition of an optical waveguide and optical element in a conventional optical module. This is disclosed in the journal *Optical Technology Contact* Vol. 36, No. 4 (1998). On a principal surface of a mounting substrate 40, a depression 42 is provided. In the depression 42 is mounted an optical element 44. On the principal surface of the mounting substrate 40 is fitted an optical waveguide 46. The end portion 48 of the optical waveguide 46 is positioned over the optical element 44. The end portion 48 forms a mirror. Light 50 emitted by the optical element 44 is reflected by the end portion 48, and enters the core 52 of the optical waveguide 46. The light 50 proceeds in the direction shown

by an arrow within the core 52, and is transmitted through the optical fiber or the like.

However, this requires both alignment accuracy when mounting the optical element on the mounting substrate and alignment accuracy between the mounting substrate on which the optical element is mounted and the optical waveguide. In particular, for an optical module such as an optical fiber requiring positioning accuracy with an error of ± 1 to $\pm 5 \mu\text{m}$, there is also a requirement to reduce as far as possible the number of locations at which this alignment accuracy is required.

Further, electronic instruments are required to be more compact and lightweight, as a result of which, compactness, light weight, and low cost are requirements for optical modules.

This invention solves this problem. The objective of this invention is the provision of an optical module which can be made more compact and lightweight.

20 DISCLOSURE OF THE INVENTION

(1) An optical module of this invention comprises:

a mounting member having a principal surface; an interconnect formed on the mounting member; and an optical element mounted on the principal surface and electrically connected to the interconnect,

wherein the mounting member is an optical waveguide for guiding light emitted from the optical element or light

admitted to the optical element.

In a conventional optical module, on a mounting member is mounted an optical waveguide separate from the mounting member. In contradistinction, this invention has 5 the mounting member and optical waveguide as an integral member. The optical module can therefore be made thinner. As a result, the optical module can be made more compact and lightweight.

In a conventional optical module, there are three 10 members involved in the positioning: the mounting member, the optical waveguide, and the optical element. On the other hand, in this invention there are two: the mounting member (optical waveguide) and the optical element. Therefore, in this invention, the optical element 15 positioning is made easier, and the bonding accuracy can be improved.

A light-admitting aperture or light-emitting aperture of the optical element may be disposed opposing the principal surface. Such an optical element may be, for 20 example, a surface-emission laser.

A light-reflecting member may be provided on the optical waveguide. Through the light-reflecting member, light can be transmitted between the optical element and the optical waveguide.

25 (2) An optical module of this invention comprises: an optical element for emitting or admitting light; and an optical waveguide having a principal surface, with the

optical element mounted on the principal surface, for guiding light emitted from the optical element or light admitted to the optical element.

This aspect of the invention has the same effect as
5 the aspect (1) of the invention.

The optical element and the optical waveguide may be fixed with an adhesive member having light transmitting characteristics interposed between the optical element and the optical waveguide in such a way that the position of
10 emission or admission of light of the optical element opposes the optical waveguide, and be subjected to bare chip mounting.

Bare chip mounting allows more compact and lightweight design than with package mounting. In this
15 aspect, since the optical element is subjected to bare chip mounting, the optical module can be made more compact and lightweight. The optical element and optical waveguide and are fixed by an adhesive member having light transmitting characteristics. By virtue of this, the optical element and
20 the optical waveguide can be fixed and an optical path between the optical element and the optical waveguide can be assured.

The optical waveguide may have a modifying portion whereby the direction of progress of the light is changed;
25 and the optical element may be positioned to overlie the modifying portion. By virtue of this, the direction of progress of the light can be efficiently changed.

The modifying portion is formed in the optical waveguide, and the optical element is directly mounted to the optical waveguide having the modifying portion. By virtue of this, the relative positioning (distance and the like) of the optical element and modifying portion can always be maintained constant, as a result of which there can be no loss of focus with respect to the modifying portion. On the other hand, in the prior art, the optical element is not mounted directly on the optical waveguide, and therefore the optical waveguide and optical element are disposed separated from each other. For this reason, when both are fixed with respect to other elements, there is a possibility of relative movement between the two. Therefore, even if the positioning operation is achieved, thereafter there is the possibility of a change in the positioning caused by various influences (heat, external pressure, and the like).

It should be noted that in the expression "positioned to overlie the modifying portion," the term "overlie" indicates that when seen projected from the optical element or modifying portion, both are disposed in positions such that it appears that both coincide.

On the principal surface of the optical waveguide may be further mounted a semiconductor element in addition to the optical element, and the optical element and the semiconductor element may be integrally sealed with a resin.

If the optical element and semiconductor element are

mounted on the principal surface of the optical waveguide,
the interconnect connecting the two may be made shorted.
The formation of the interconnect on the mounting substrate
can be single layer, and the interconnect formation is made
5 easier. If the optical element and semiconductor element
are integrally sealed with a resin, the strength of the
optical module can be improved. If the optical element and
semiconductor element are hybrid, the degree of integration
of the optical module can be improved. By the improvement
10 of this degree of integration, the cost can be lowered.

The resin may have light blocking characteristics. If
light impinges on the semiconductor element, faulty
operation of the semiconductor element is possible. By
sealing the semiconductor element with a resin having light
15 blocking characteristics, faulty operation can be prevented.

The semiconductor element may have a function of
driving the optical element.

Since the optical element and the semiconductor
element driving or controlling the optical element are
20 mounted on the principal surface of the optical waveguide,
the optical module can be made a module of high added value.
A higher degree of integration of the optical module and a
lower cost can also be achieved.

A circuit may be laminated directly on the principal
25 surface of the optical waveguide. If a circuit is laminated
directly on the principal surface of the optical waveguide,
the mounting of the semiconductor element is not required.

Therefore, it is no longer necessary to consider the reliability of connection between different components. In respect of connections between integrated circuit elements, the connections can be eliminated, and by virtue of this, 5 the interconnect impedance characteristics and noise characteristics can be improved, while the effect of delays can be held to a minimum. The degree of integration on the principal surface of the optical waveguide can be improved, and a high degree of integration of the optical module and 10 low cost can be achieved.

(3) An optical module of the invention comprises: an optical element; and a mounting member which has a function of an optical waveguide for guiding light emitted from the optical element or light admitted to the optical element 15 and is electrically connected to the optical element or a semiconductor element associated therewith.

This aspect of the invention has the same effect as the aspect (1) of the invention.

(4) An optical module of this invention comprises: a 20 mounting member having a principal surface and a lateral surface; and an optical element mounted on the principal surface, wherein the mounting member has a function of an optical waveguide, and an optical input/output terminal for the optical waveguide is provided on the lateral surface of 25 the mounting member.

This aspect of the invention has the same effect as the aspect (1) of the invention. It should be noted that an

optical input/output terminal means a terminal at which light is input, or a terminal at which light is output, or a terminal at which light is input and/or output.

It should be noted that optical elements include both
5 elements which emit light and elements which receive light.
The mounting member may be in plate, film, or other form,
as long as it allows the optical element to be mounted.

BRIEF DESCRIPTION OF THE DRAWINGS

10 Fig. 1 shows a schematic cross-section of one embodiment of the optical module of this invention;

Fig. 2 shows a schematic plan view of one embodiment of the optical module of this invention; and

15 Fig. 3 shows schematically the relative disposition of the optical waveguide and optical element of a conventional optical module.

BEST MODE FOR CARRYING OUT THE INVENTION

Structure

20 Fig. 1 shows a schematic cross-section of one embodiment of the optical module of this invention. Fig. 2 shows a schematic plan view thereof. A glass mounting substrate 10 doubles as an optical waveguide. Thus, within the mounting substrate 10 are formed a core 12 and cladding 25 14 extending along the surface for mounting an optical element on the mounting substrate 10. The core 12 and cladding 14 are formed within the mounting substrate 10 by

using thin-film formation techniques, photolithography, or the like.

One end portion 18 of the optical waveguide forms a 45-degree mirror by which the light is bent through 90 degrees. The 45-degree mirror is formed by using for example a 90-degree V-shape diamond saw, to machine the end portion 18 of the optical waveguide. On the lateral surface of the mounting substrate 10, and at the other end portion of the optical waveguide, is disposed an optical output terminal 29. Light passes along the core 12, and is output from the optical output terminal 29.

On the mounting substrate 10, interconnects 16a, 16b, and 16c are formed from a metal foil or the like. In this embodiment, the interconnects 16a, 16b, and 16c are formed on the principal surface of the mounting substrate 10, but these may equally be formed on a lateral surface of the mounting substrate 10. Alternatively, interconnects may be formed on the surface opposite to the principal surface of the mounting substrate 10 (the rear surface), and may be electrically connected to the principal surface through through holes or the like formed in the mounting substrate 10. Instead, the interconnects may be formed on any two or all of the principal surface, a lateral surface and the rear surface of the mounting substrate 10. It should be noted that the largest surface of the mounting substrate 10 is commonly the principal surface, but even if not the largest surface, the surface on which it is possible to

mount the optical element is the principal surface.

A semiconductor chip 20 is electrically connected by the flip-chip bonding to the interconnects 16a and 16c. That is to say, metal bumps are formed on the electrodes of 5 the semiconductor chip 20, and the semiconductor chip 20 is connected to the mounting substrate 10 forming the interconnect substrate by the face-down bonding. The semiconductor chip 20 has a CMOS circuit, for example. The interconnect 16c forms an electrical input/output terminal.
10 In this embodiment, one semiconductor chip 20 is fitted, but a plurality of semiconductor chips 20 may be fitted. For example, a plurality of semiconductor chips 20 may be fitted corresponding to a plurality of optical elements.

A surface-emission laser 22 is electrically connected 15 to an interconnect 16b by the flip-chip bonding. On one surface of the surface-emission laser 22 is formed an electrode 24. On the other surface are formed electrodes 26 and a light-emitting aperture 28. The surface-emission laser 22 is disposed on the principal surface of the 20 mounting substrate 10 so that light emitted from the aperture 28 is reflected by the end portion 18, to pass along the core 12. The electrodes 26 and interconnect 16b are electrically connected. The emitting aperture 28 and electrodes 26 are sealed with a transparent resin 34 having 25 light transmitting characteristics. The transparent resin 34 is a silicone resin having light transmitting characteristics. The electrode 24 is electrically connected

to the interconnect 16a by a wire 30. In this embodiment, a plurality of surface-emission lasers 22 are provided as an example of a plurality of optical elements, but the present invention is not limited to this. For example, a single 5 optical element may be provided, and this optical element may have a plurality of light-admitting apertures or light-emitting apertures. Naturally, a single optical element with a single light-admitting aperture or light-emitting aperture may also be provided.

10 The semiconductor chip 20 and surface-emission laser 22 are sealed with a resin 36 having light blocking characteristics. However, the resin 36 is provided in such a way as not to impede the passage of light between the optical element (for example, the surface-emission laser 15 22) and the optical waveguide (for example the core 12). The resin 36 is an epoxy resin. The components of the epoxy resin are from 10 to 50 per cent epoxy and from 90 to 50 per cent filler (silica or the like). In this embodiment, three optical waveguides are aligned in parallel. That is 20 to say, the three cores 12 forming the three optical waveguides are formed within the mounting substrate 10. Moreover, the three cores 12 (optical waveguides) are disposed in parallel, and the optical output terminal 29 of each of their cores 12 (optical waveguides) are formed on 25 the same lateral surface of the mounting substrate 10. The three surface-emission lasers 22 connected to the optical waveguides are mounted on the mounting substrate 10 at the

end distant from the optical output terminals 29.

Operation

Electrical signals from the semiconductor chip 20 are transferred to the surface-emission laser 22. By this means, the surface-emission laser 22 emits light 32. The light 32 is emitted from the emitting aperture 28, and at the end portion 18 of the optical waveguide is reflected through 90 degrees. Then it proceeds along the center of the core 12 in the direction of the arrow, and is transmitted through the optical output terminal 29 to an optical fiber or the like.

Effect

In this embodiment, the mounting substrate 10 doubles as an optical waveguide. Therefore, the optical module can be made thinner. As a result, the optical module can be made more compact and lightweight.

In this embodiment, when aligning the optical waveguide and surface-emission laser 22, there are two items involved in the positioning: the mounting substrate 10 (optical waveguide) and the surface-emission laser 22. Thus the bonding of the surface-emission laser and the optical waveguide which conventionally was complicated and time-consuming is simplified, and the bonding strength can also be improved. Additionally, the costs associated with bonding can be reduced.

Other matters

In this embodiment, the direction of the light is changed by a 45-degree mirror. However, this is not 5 limitative of the invention, and thus any other component appropriate for changing the direction of the light may be applied in the invention.

In this embodiment, the direction of the light is changed at the end portion of the waveguide. However, this 10 is not limitative of the invention, and the direction of the light may be changed at a portion other than the end portion of the waveguide.

In this embodiment, the surface-emission laser 22 must inject light into the optical waveguide, and therefore 15 the mounting position of the surface-emission laser 22 is restricted. However, the semiconductor chip 20 can be mounted anywhere as long as it is on the principal surface of the mounting substrate 10.

In this embodiment, the surface-emission laser 22 and 20 semiconductor chip 20 are mounted on the mounting substrate 10 by the flip-chip bonding. However, this is not limitative of the invention, and the surface-emission laser 22 or semiconductor chip 20 may equally be mounted by face-up bonding or the like.

25 In this embodiment, the semiconductor chip 20 is mounted on the mounting substrate 10. However, this is not limitative of the invention, and on the principal surface

of the mounting substrate 10 may be formed a circuit of thin-film transistors, which may be used in place of the semiconductor chip 20. Alternatively, with such a thin-film transistor circuit and the semiconductor chip 20 may be 5 formed a circuit to send signals to the surface-emission laser 22.

In this embodiment, the mounting substrate 10 is made of glass. However, this is not limitative of the invention, and a polymer or suchlike film may be used for the mounting 10 substrate 10.

In this embodiment, the surface-emission laser 22 constitutes an optical element. However, this is not limitative of the invention, and a laser diode, photodiode, or other optical element may equally be used.

15

CLAIMS

1. An optical module comprising:
 - a mounting member having a principal surface;
 - 5 an interconnect formed on said mounting member; and
 - an optical element mounted on said principal surface and electrically connected to said interconnect,
 - wherein said mounting member is an optical waveguide for guiding light emitted from said optical element or
 - 10 light admitted to said optical element.
2. The optical module as defined in claim 1,
 - wherein a light-admitting aperture or light-emitting aperture of said optical element is disposed opposing said
 - 15 principal surface.
3. The optical module as defined in claim 2,
 - wherein a light-reflecting member is provided on said optical waveguide; and
 - 20 wherein light is transmitted between said optical element and said optical waveguide through said light-reflecting member.
4. An optical module comprising:
 - 25 an optical element for emitting or admitting light;
 - and
 - an optical waveguide having a principal surface, with

5 said optical element mounted on said principal surface, for
9 guiding light emitted from said optical element or light
13 admitted to said optical element.

5 5. The optical module as defined in claim 4,
9 wherein said optical element and said optical
13 waveguide are fixed with an adhesive member having light
17 transmitting characteristics interposed between said
21 optical element and said optical waveguide in such a way
25 that the position of emission or admission of light of said
30 optical element opposes said optical waveguide, and are
34 subjected to bare chip mounting.

5 6. The optical module as defined in claim 5,
9 wherein said optical waveguide has a modifying
13 portion whereby the direction of progress of said light is
17 changed; and
21 wherein said optical element is positioned to overlie
25 said modifying portion.

5 20 7. The optical module as defined in claim 4,
9 wherein a semiconductor element is further mounted on
13 said principal surface in addition to said optical element;
17 and
21 wherein said optical element and said semiconductor
25 element are integrally sealed with a resin.

8. The optical module as defined in claim 5,
wherein a semiconductor element is further mounted on
said principal surface in addition to said optical element;
and

5 wherein said optical element and said semiconductor
element are integrally sealed with a resin.

9. The optical module as defined in claim 6,
wherein a semiconductor element is further mounted on
10 said principal surface in addition to said optical element;
and

wherein said optical element and said semiconductor
element are integrally sealed with a resin.

15 10. The optical module as defined in claim 7, wherein
said resin has light blocking characteristics.

11. The optical module as defined in claim 8, wherein
said resin has light blocking characteristics.

20 12. The optical module as defined in claim 9, wherein
said resin has light blocking characteristics.

13. The optical module as defined in claim 7, wherein
25 said semiconductor element has a function of driving said
optical element.

14. The optical module as defined in claim 8, wherein
said semiconductor element has a function of driving said
optical element.

5 15. The optical module as defined in claim 9, wherein
said semiconductor element has a function of driving said
optical element.

10 16. The optical module as defined in any of claims 4 to
15, wherein a circuit is laminated directly on said
principal surface.

15 17. An optical module comprising:

an optical element; and

20 18. A mounting member which has a function of an optical
waveguide for guiding light emitted from said optical
element or light admitted to said optical element and is
electrically connected to said optical element or a
semiconductor element associated with said optical element.

25 19. An optical module comprising:

a mounting member having a principal surface and a
lateral surface; and

an optical element mounted on said principal surface,

25 20. wherein said mounting member has a function of an
optical waveguide, and an optical input/output terminal for
said optical waveguide is provided on said lateral surface.

ABSTRACT

An optical module which can be made more compact and lightweight. An end portion (18) of a mounting substrate 5 (10) forms a mirror which reflects light through 90 degrees. A surface-emission laser (22) is disposed so that a light-emitting aperture (28) faces the end portion (18). Within the mounting substrate (10) are formed a core (12) extending along the plane of the mounting substrate (10) 10 and a cladding (14). The mounting substrate (10) doubles as an optical waveguide. Therefore, the optical module can be made thinner. As a result, the optical module can be made more compact and lightweight.

15

09/509669

430 Rec'd PCT/PTO 3-1 MAR 2000

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Akihiro MURATA and Shojiro KITAMURA

Application No.: U.S. National Stage of
PCT/JP99/03927

Filed: March 31, 2000

Docket No.: 105895

For: OPTICAL MODULE

REQUEST FOR APPROVAL OF DRAWING CORRECTION

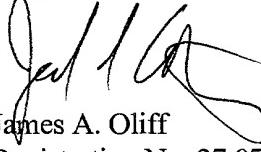
Director of the U.S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

The Examiner is requested to review and approve the proposed correction to Figure 3, marked in red on the attached copy of such drawing figure.

Upon approval by the Examiner, and upon allowance of this application, the formal drawings will be corrected.

Respectfully submitted,


James A. Oliff
Registration No. 27,075

Joel S. Armstrong
Registration No. 36,430

JAO:JSA/emb

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Telephone: (703) 836-6400

FIG. 2

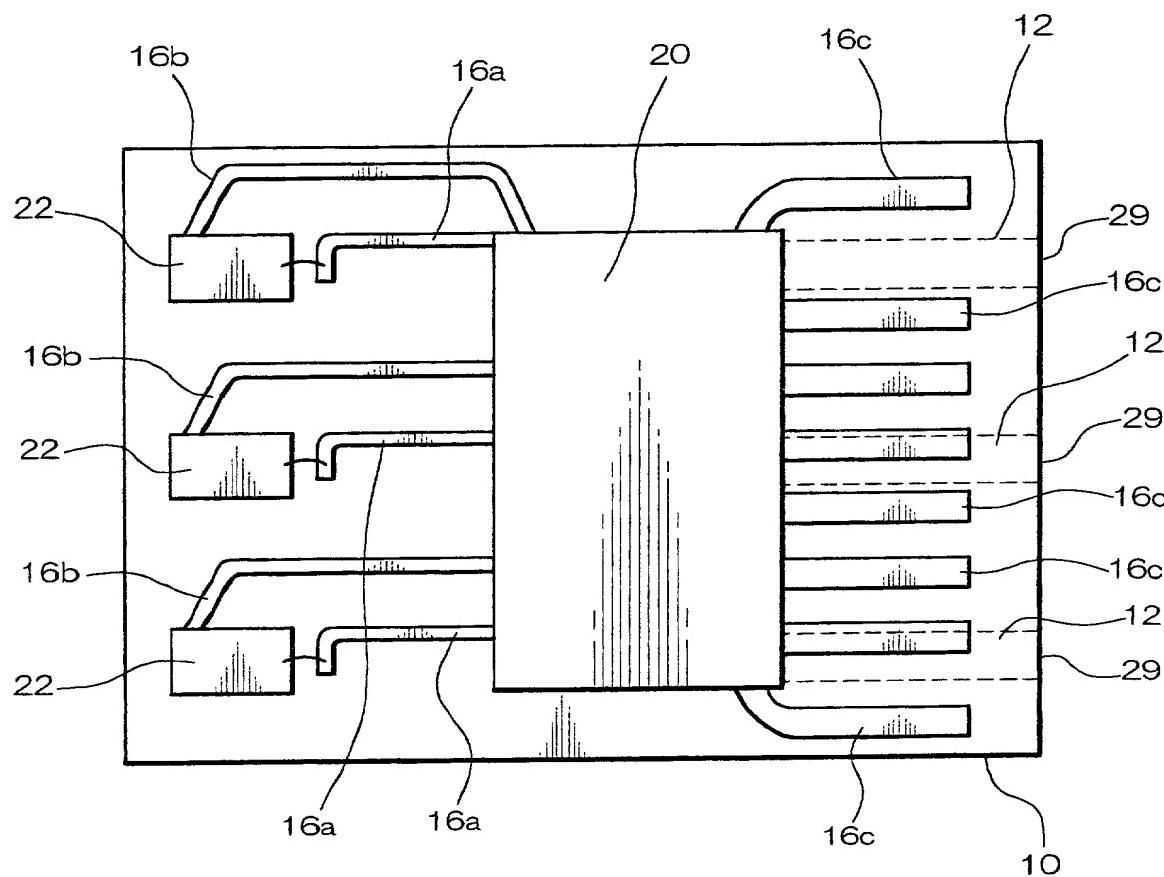
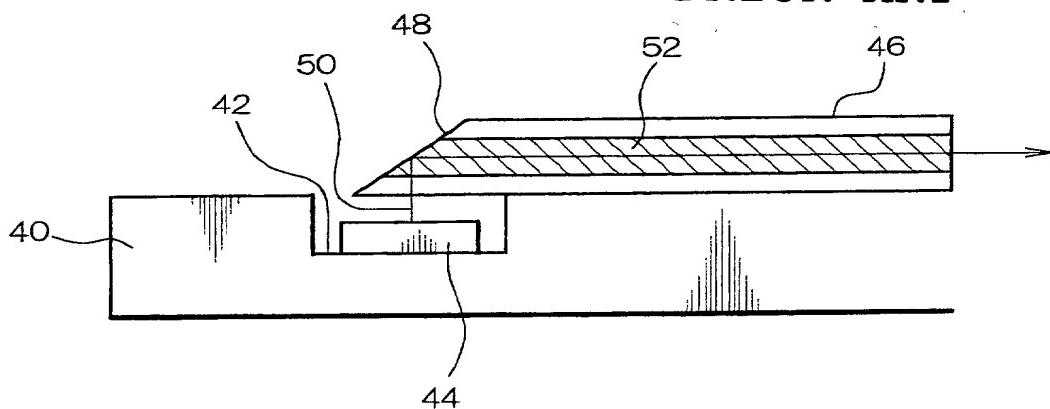


FIG. 3

PRIOR ART

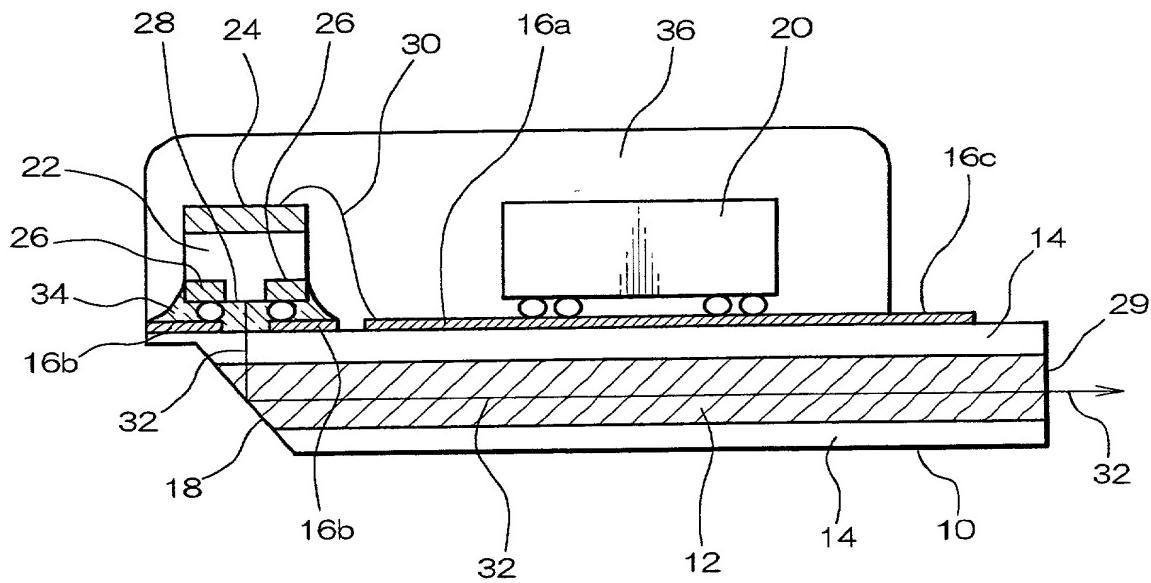
✓ please insert



09/509669

1 / 2

FIG. 1



2 / 2

FIG. 2

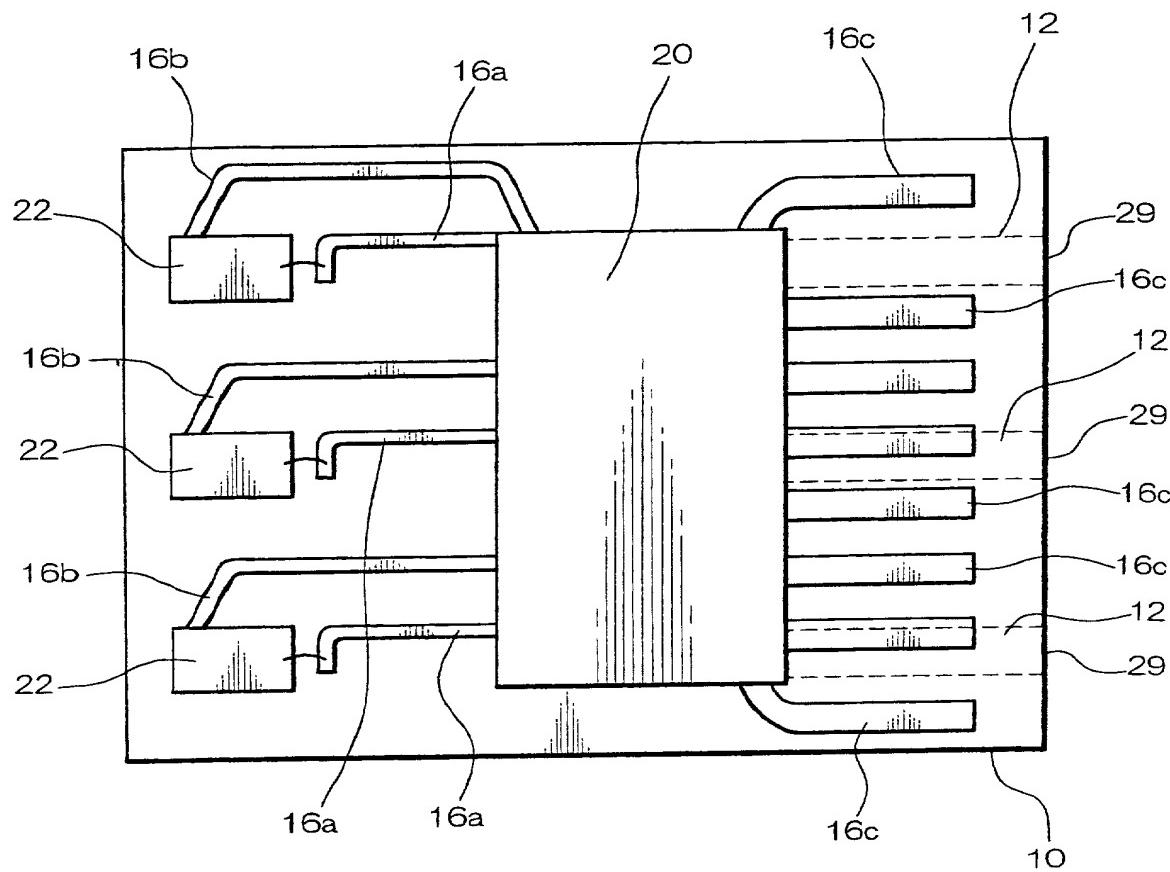
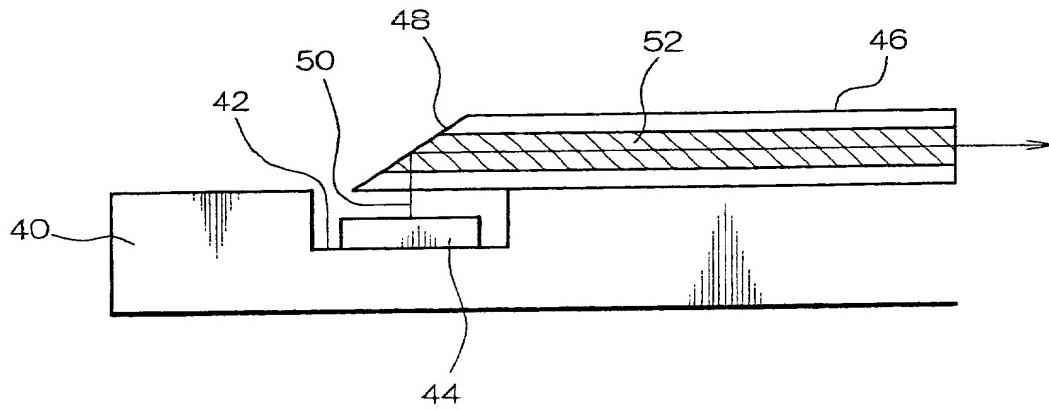


FIG. 3



Seiko Epson Ref. No.: F004518US00

Attorney's Ref. No.:**Declaration and Power of Attorney For Patent Application**

特許出願宣言書及び委任状

Japanese Language Declaration

日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

私の住所、私書箱、国籍は、下記の私の氏名の後に記載された通りです。

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者であると（下記の名称が複数の場合）信じています。

光モジュール

上記発明の明細書（下記の欄で×印がついていない場合は、本書に添付）は、

- 1999年7月22日に提出され、米国出願番号または
特許協定条約 国際出願番号をPCT/JP99/03927 とし、
(該当する場合) _____ に訂正されました。

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

私は、連邦規則法典第37編第1条56項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

OPTICAL MODULE

the specification of which is attached hereto unless the following box is checked:

- was filed on July 22, 1999
as United States Application Number or
PCT International Application Number
PCT/JP99/03927 and was amended on
_____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

Japanese Language Declaration

(日本語宣言書)

私は、米国法典第35編119条(a)-(d)項又は365条(b)項に基づく記載の、米国以外の國の少なくとも1ヶ国を指定している特許協力条約365条(a)項に基づく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。

Prior Foreign Application(s)

外国での先行出願

10-233608(Number)
(番号)Japan(Country)
(国名)05/August/1998(Day/Month/Year Filed)
(出願年月日)**Priority Not Claimed**

優先権主張なし

(Number)
(番号)(Country)
(国名)(Day/Month/Year Filed)
(出願年月日)

私は、第35編米国法典119条(e)項に基いて下記の米国特許出願規定に記載された権利をここに主張いたします。

(Application No.)
(出願番号)(Filing Date)
(出願日)

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PCT/JP99/03927(Application No.)
(出願番号)22/July/1999(Filing Date)
(出願日)(Application No.)
(出願番号)(Filing Date)
(出願日)

私は、私自身の知識に基づいて本宣言書中で私が行なう表明が真実であり、かつ私が入手した情報と私の信じるところに基づく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第18編第1001条に基づき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行なえば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Priority Not Claimed

優先権主張なし

I hereby claim the benefit under Title 35, United States Code, Section 119 (e) of any United States provisional application(s) listed below.

(Application No.)
(出願番号)(Filing Date)
(出願日)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or 365 (c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application:

Pending(Status: Patented, Pending, Abandoned)
(現況:特許許可済、係属中、放棄済)(Status: Patented, Pending, Abandoned)
(現況:特許許可済、係属中、放棄済)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Japanese Language Declaration

(日本語宣言書)

委任状：私は、下記の発明者として、本出願に関する一切の手続きを米特許商標局に対して遂行する弁理士または代理人として、下記の者を指名いたします。（弁護士、または代理人の氏名及び登録番号を明記のこと）

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